PEEP/PIP valve

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1 Calibration

Calibrate the PEEP/PIP valve if one of the following conditions applies:

- during each inspection/maintenance
- after replacing the PEEP/PIP valve
- after replacing the Pneumatic Controller PCB
- if the PEEP/PIP pressure values are no longer correct

1.1 Electrical calibration

The following electrical calibration is carried out with a pneumatically short-circuited patient system.

The PEEP/PIP valve is triggered in a defined manner and the output pressure is measured with the “expiration” pressure sensor. The “offset” and “gain” are measured at 3 mbar and 34 mbar and stored in the EEPROM on the Pneumatic Controller PCB.

1 Connect the device to the “O2” and “AIR” central supply systems.
2 Disconnect the ventilation hoses from the inspiratory socket and expiratory socket.
3 Remove the flow sensor.
4 Remove the patient system from the device.

5 Unscrew the diaphragm cover from the patient system (Fig. 1) and remove the diaphragm.

6 Screw the diaphragm cover onto the patient system.

7 Seal the expiratory socket (Fig. 1) with a rubber plug.

8 Remove the “flow sensor connection” lip seal (Fig. 1) and seal the connection with a rubber plug.

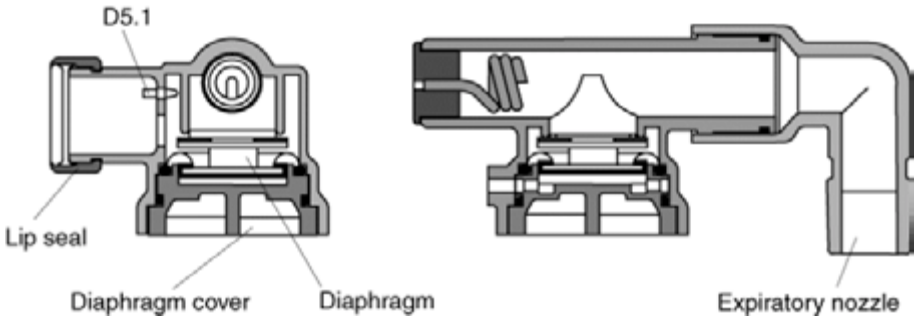

Fig. 1 Patient system

9 Install the patient system on the device.

10 Switch the device on and set to “standby” mode.

11 Press the “System Setup” key.

12 Press the “Service” softkey.

13 To start the calibration procedure, enter the following numbers in sequence: 4 7 9 9 4 7 4 7.

The calibration may take more than 1 minute.

The calibration has been completed successfully if a flow pulse of 0.2 seconds can be heard at the inspiratory socket.

If a flow pulse of 1 second is audible, the calibration must be repeated. If calibration fails several times, carry out a mechanical zero calibration, see 1.2 Mechanical zero calibration. Then repeat the electrical calibration, see 1.1 Electrical calibration.

14 Restore the patient system to its correct condition (Note: Make sure that the sealing to the flow sensor is fitted correctly and that the non-return valve D 5.1 is not broken).

15 Reassemble the device.

16 Check the device as described in the PMS procedure.

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1.2 Mechanical zero calibration

Prerequisites:

- the supply pressure is 2 bar
- the output pressures of pressure regulators DR1.1 (AIR) and DR1.2 (O2) are within permissible tolerance
- without power supply the restrictor has a flow rate of 3.5 L/min
- the output pressure of the PEEP/PIP valve is -1 mbar

1 Connect the device to the “O2” and “AIR” central supply systems.

2 Open the pneumatic assembly, see “Opening the device”.

3 Switch the device on.

4 Switch the device to “Standby” mode.

5 Disconnect the connector “X5” of the PEEP/PIP valve from the Pneumatic Controller PCB.

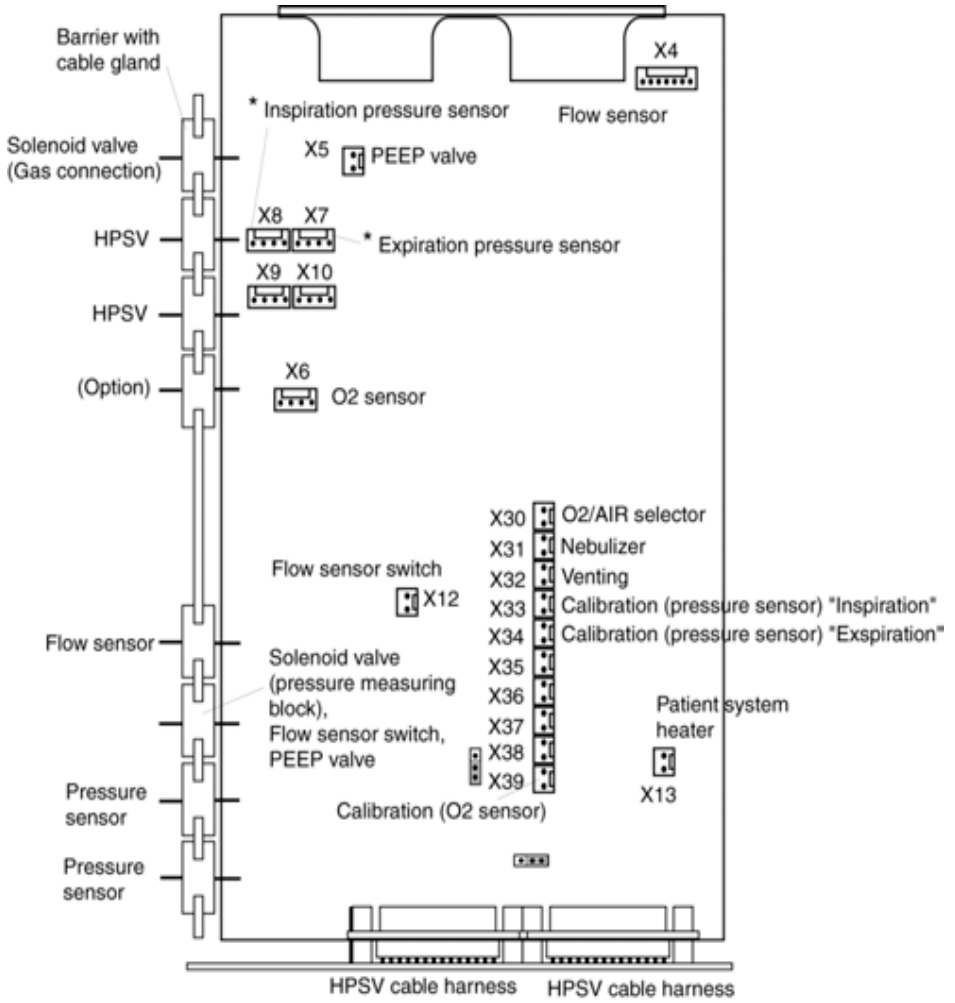

Fig. 2 Pneumatic Controller PCB (pin assignment)

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6 Using a secretion sightglass and a pressure gauge (measuring range + 12 mbar to -12 mbar) measure the output pressure of the PEEP/PIP valve at the lip seal.

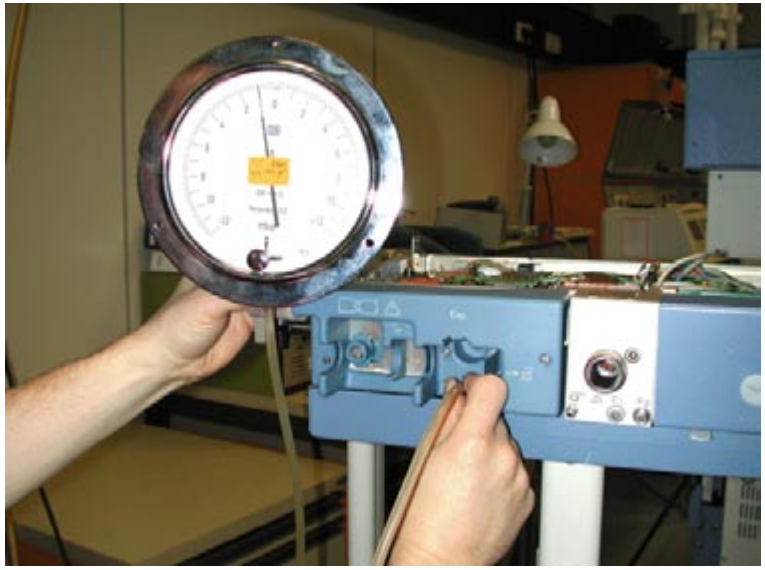

Fig. 3 Pressure measurement at the lip seal

The target value is -1 mbar +/- 1 mbar.

If the target value is achieved, reconnect the power supply of the PEEP/PIP on the Pneumatic Controller PCB to “X5” and carry out the electrical calibration of the PEEP/PIP valve, see 1.1 Electrical calibration.

If the target value is not achieved, carry out the mechanical zero calibration of the PEEP/PIP valve. To do so, remove the left-hand accessories rail and the side plate from the pneumatic assembly.

7 Unscrew the PEEP/PIP valve including fixing bracket.

8 Connect the hose to connection “7”.

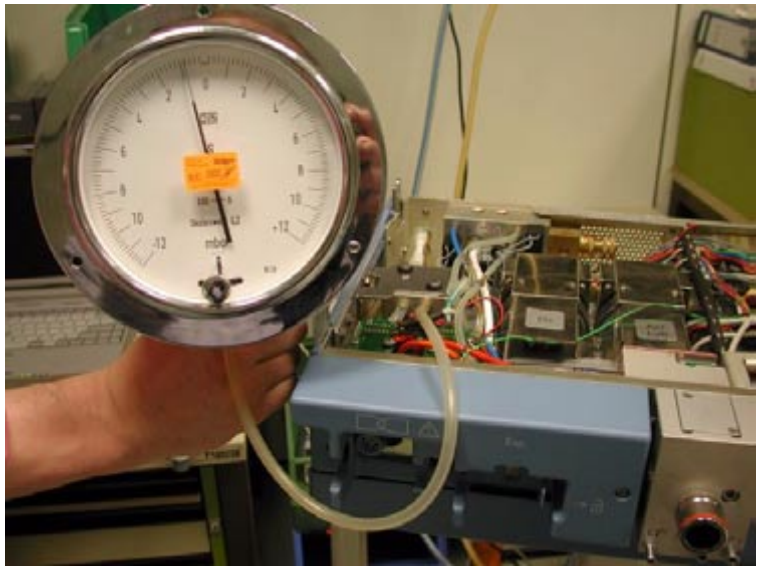

Fig. 4 Pressure measurement at PEEP/PIP valve

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9 Using the stud screw (located on the underside of the PEEP/PIP valve) set the mechanical zeropoint to -1 mbar +/-1 mbar. (Note: The PEEP/PIP valve must be operated in mounting position, do not tilt it!) Unscrew the stud screw a little until the measured value stops decreasing.

10 Then screw in the stud screw until the measured value increases again and is within tolerance. This is important to ensure a frictional connection between the drive and the diaphragm assembly in the PEEP/PIP valve.

11 Secure the stud screw with screw stop varnish.

12 Install the PEEP/PIP valve including fixing bracket.

13 Install the left-hand accessories rail including side plate.

14 Reconnect the connector “X5” of the PEEP/PIP valve to the Pneumatic Controller PCB.

The calibration is carried out without the patient system.

15 Disconnect the hoses from connection “7” of the PEEP/PIP valve and from connection “8” of the pressure measuring block (expiratory pressure sensor).

16 Connect a silicone hose between connector “7” of the PEEP/PIP valve and connection “8” of the pressure measuring block.

17 Press the “System Setup” key.

18 Press the “Service” softkey.

19 To start the calibration procedure, enter the following numbers in sequence: 4 7 9 9 4 7 4 7.

The calibration has been completed successfully if a flow pulse of 0.2 seconds can be heard at the inspiratory socket. Continue with step 20.

Calibration failed if a flow pulse of 1 second duration can be heard. In this case repeat the PEEP/PIP valve calibration. Continue with step 19.

If calibration fails several times, check whether two pressure values of approx. 3 and 34 mbar can be reached in sequence (8 times max.) by additionally measuring the output pressure between connection “7” and “8”.

Possible error causes:

- the PEEP/PIP valve is faulty
- the power source on the Pneumatic Controller PCB is faulty

20 Disconnect the silicone hose from connection “7” of the PEEP/PIP valve and connection “8” of the pressure measuring block.

21 Connect hoses to connection “7” of the PEEP/PIP valve and to connection “8” of the pressure measuring block (expiratory pressure sensor).

22 Close the pneumatic assembly and secure it to the unit with the screws.

23 Perform “electrical safety tests” and “function tests” as described in the PMS procedure. For the USA and Canada: test according to CAN/CSA-22.2 No. 601.1-M90.

2 Testing the power source

1 Open the pneumatic assembly, see “Opening the device”.

2 Measure the voltage of the PEEP/PIP valve at the X15 test points on the Pneumatic Controller PCB, see Fig. 5 (Note: 1 mV corresponds to 1 mA current across the coil of the PEEP/PIP valve).

3 Switch the device on.

4 Switch the device to “Standby” mode.

5 Press the “System Setup” key.

6 Press the “Service” softkey.

7 To start the calibration procedure, enter the following numbers in sequence: 4 7 9 9 4 7 4 7.

The target values during the first calibration attempt are approx. 16 and 140 mV.

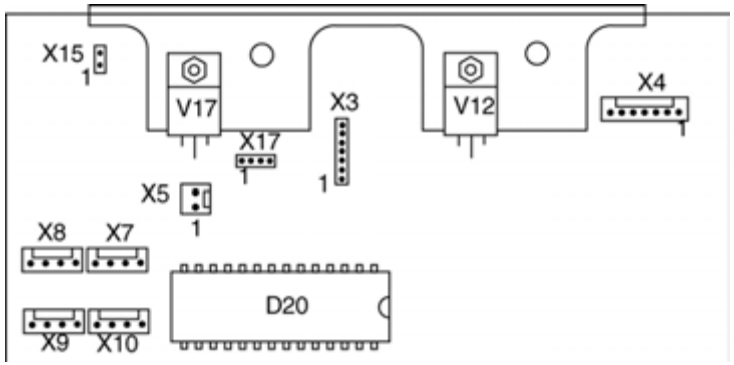

Fig. 5 Detail of the Pneumatic Controller PCB

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If the voltage values differ considerably, the PEEP/PIP valve current control on the Pneumatic Controller PCB could be faulty. If no current can be measured, the PEEP/PIP valve is not connected.

The calibration has been completed successfully if a flow pulse of 0.2 seconds can be heard at the inspiratory socket.

8 Restore the connection between the connections “7” and “8” as shown in the pneumatics tubing diagram.

9 Close the pneumatic assembly and secure it to the unit with the screws.

10 Perform “electrical safety tests” and “function tests” as described in the PMS procedure. For the USA and Canada: test according to CAN/CSA-22.2 No. 601.1-M90.

3 Replacing the PEEP/PIP valve

1 Switch off the device.

2 Unplug the power plug of the machine from the socket-outlet.

3 Disconnect the compressed-gas connectors of the device from the terminals of the central supply system.

Electrostatic discharge may damage electrostatic sensitive devices. When handling electrostatic sensitive devices, use a static-dissipative mat and a static dissipative wrist strap.

4 Create ESD conditions.

5 Fold up the electronic assembly, see chapter “Opening the device”.

6 Disconnect the hoses from the PEEP/PIP valve.

7 Carefully remove the shrink tubings from the connection cable on the PEEP/PIP valve.

8 Unsolder the connection cable from the PEEP/PIP valve.

9 Remove screws (Fig. 6/1).

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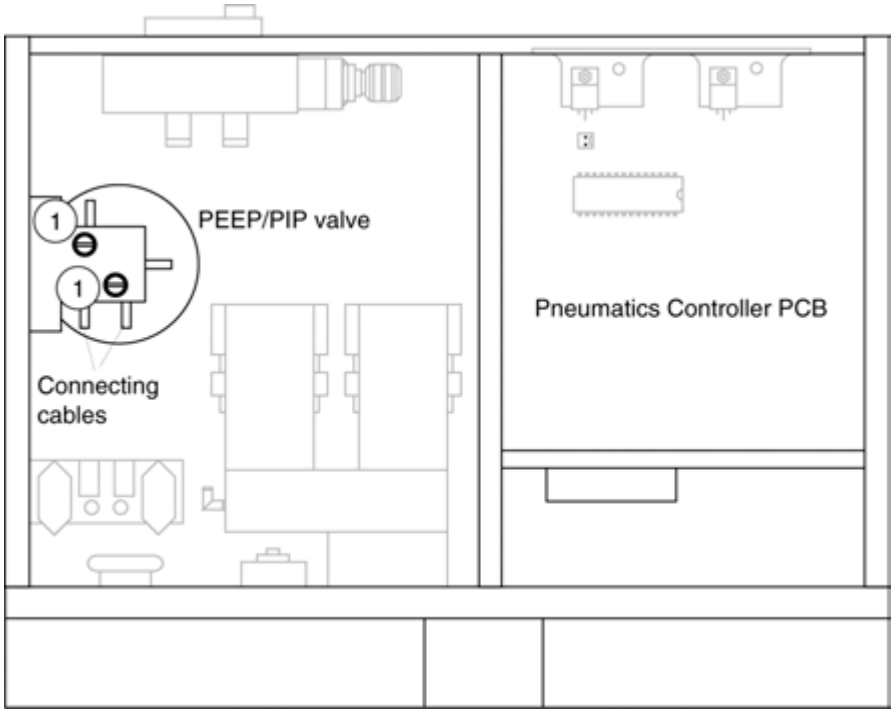

Fig. 6 Removing the PEEP/PIP valve

10 Remove the faulty PEEP/PIP valve from the device and dispose of the faulty PEEP/PIP valve in accordance with local waste disposal regulations.

Kinked or squeezed hoses adversely affect the function of the PEEP/PIP valve. Do not kink or squeeze any hoses when installing the new PEEP/PIP valve.

When securing the PEEP/PIP valve to the fixing bracket make sure that the PEEP/PIP valve is electrically insulated! To do so use the insulating plate and the two plastic sleeves for the screws.

11 Secure the new PEEP/PIP valve to the fixing bracket using the screws (Fig. 6/1).

12 Slide new shrink tubings over the electrical connection cables of the PEEP/PIP valve.

13 Solder the connection cable to the PEEP/PIP valve.

14 Slide the shrink tubings over the soldering joints of the connection cables and shrink the tubings.

15 Calibrate the PEEP/PIP valve, see section 1.1 Electrical calibration.

16 Close the pneumatic assembly and secure it to the unit with the screws.

17 Perform “electrical safety tests” and “function tests” as described in the PMS procedure. For the USA and Canada: test according to CAN/CSA-22.2 No. 601.1-M90.